West Antarctica - Elevation Profiles from ICESat

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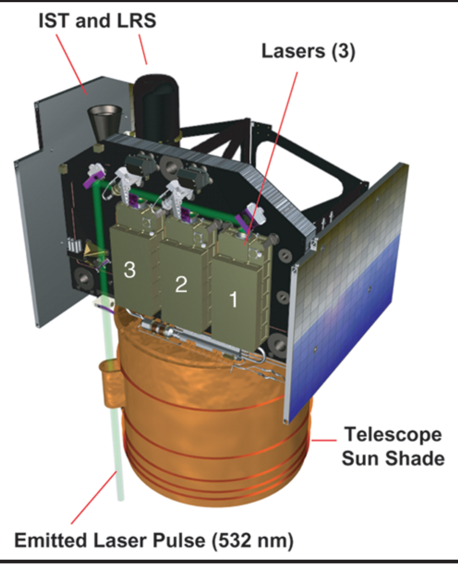
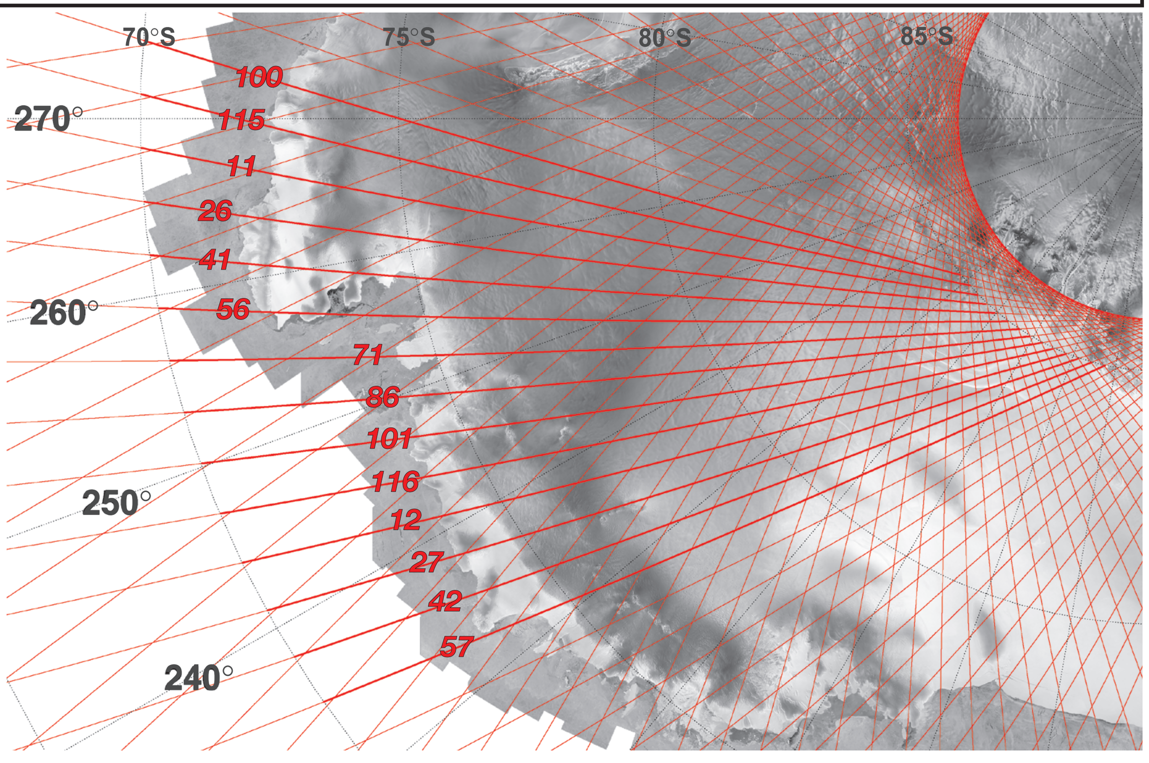
Ice, Cloud, and land Elevation Satellite - Mission Status:

- Carries the Geosciences Laser Altimeter System (GLAS) which uses 1064 and 532 nm laser energy as well as precise GPS and star-trackers to determine primary science parameters: precise elevations and cloud and aerosol distribution and structure
- Launched January 12, 2003 from Vandenberg AFB, Lompoc, California on a Delta II rocket, successfully separated then established communications and deployed solar arrays, began acquiring elevation data on February 20, 2003 over the North Atlantic from GLAS Laser 1 using 1064 nm altimetry detectors only, 532 nm detectors not initially enabled due to engineering concerns
- GLAS Laser 1 ceased abruptly on March 29th, extensive NASA reviews find that the likely cause is gold-indium contact and related effects during laser diode bar manufacturing, review summary reports available soon
- Following 'rescoping' of the mission, GLAS Laser 2 begins operations on ~September 18th with both 1064 nm and 532 nm detectors



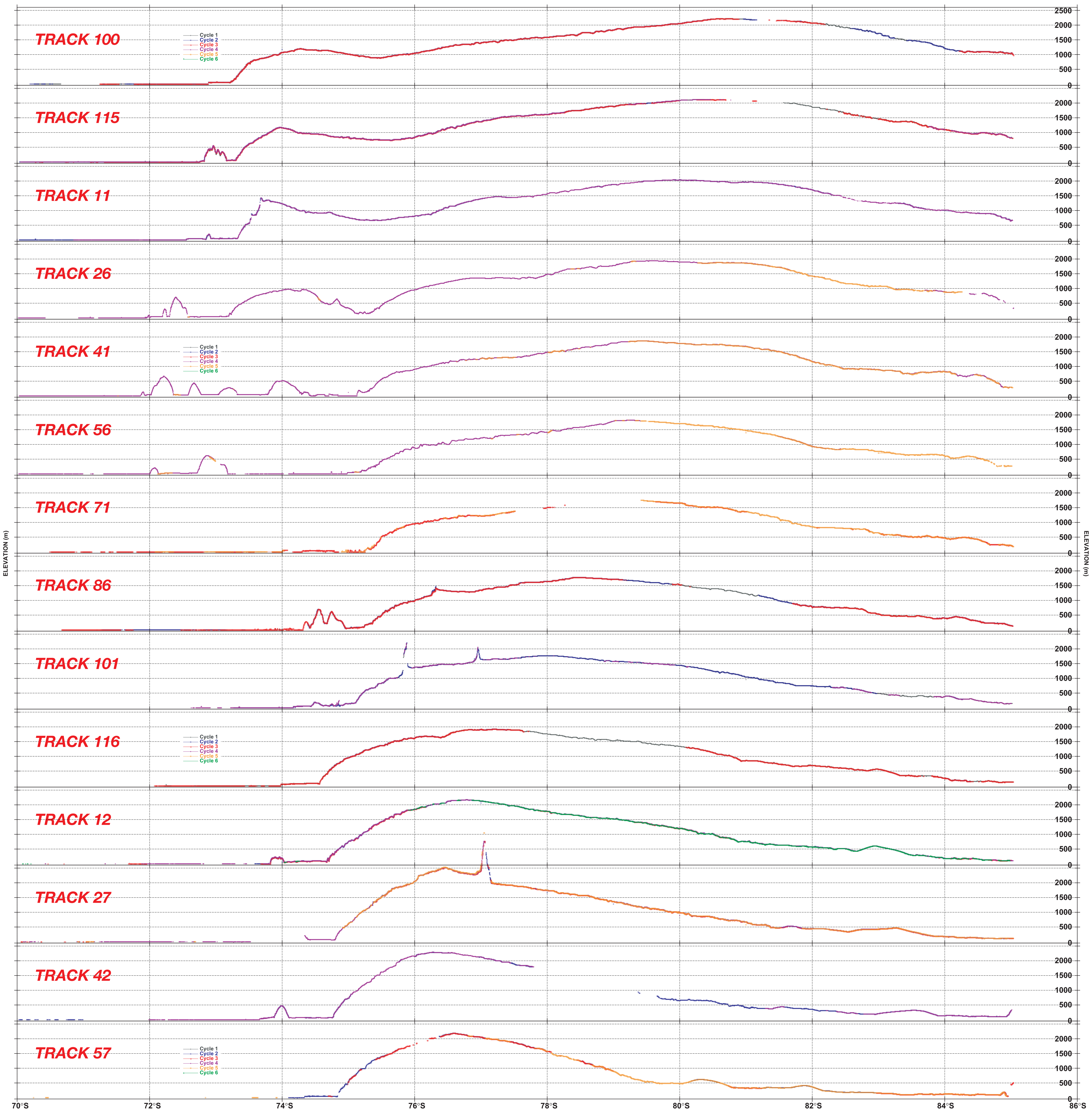
ICESat Elevation Data - Tracks and Cycles:

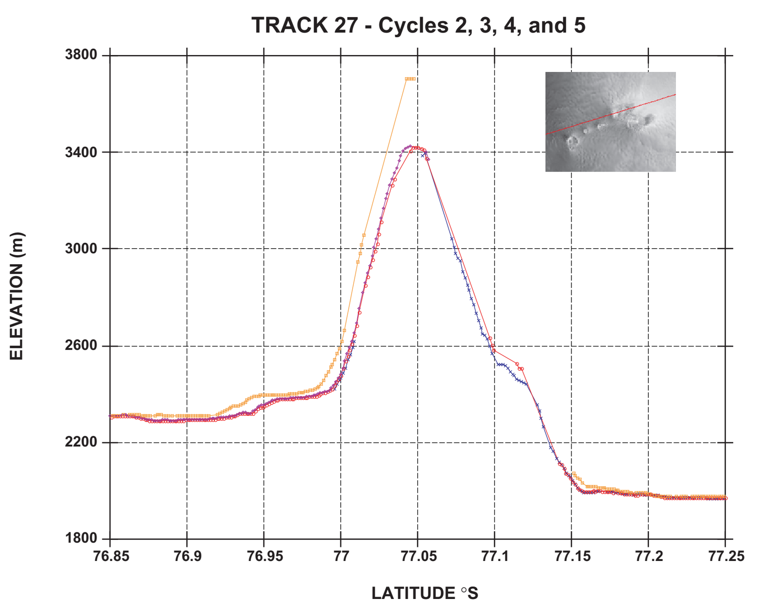
- Data used here are from GLAS Laser 1 and were acquired in the 8-day repeat orbit beginning with Track 72, Cycle 1 continuing until Track 23, Cycle 6 when Laser 1 ceased emitting
- The satellite descends until 86°S (the red ring) then it ascends, each track is actually a sequence of elevation (or cloud) observations spaced ~170 m apart, an orbit takes ~97 minutes, and the Earth's rotation accounts for spacing of sequential tracks
- The track pattern was repeated every 8 days for calibration/validation activities, precise elevations can be obtained from track crossovers and data from each track's multiple cycles through time
- The specific tracks used in this study (all descending) across the WAIS are highlighted on part of the Radarsat mosaic (mosaic from NSIDC, ground track overlay from B. Schutz and M. Beckley)
- Data are from ICESat-Investigator-led Science Processing System Release 11 with geoid correction



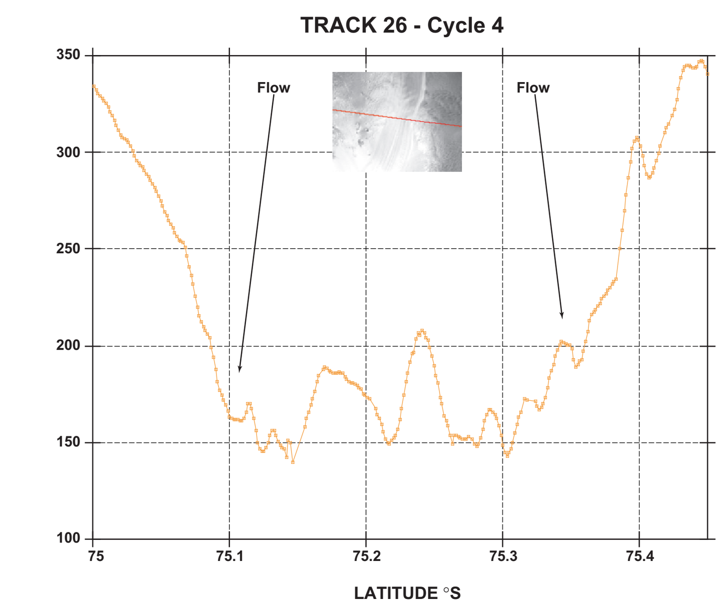
ICESat Elevation Data - West Antarctic Ice Sheet Divide:

- Elevation data are composites due to the impact of atmospheric phenomena on signal processing, some gaps still exist; also note that precise repeat track pointing (ability to follow a ground track to ±50 m) was not enabled during Laser 1 period, so repeat tracks can be separated by ~kilometer with resulting elevation offsets

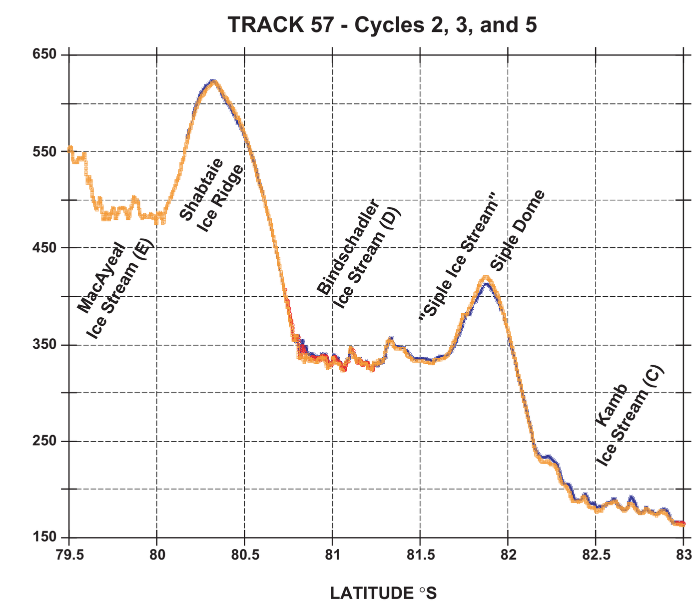




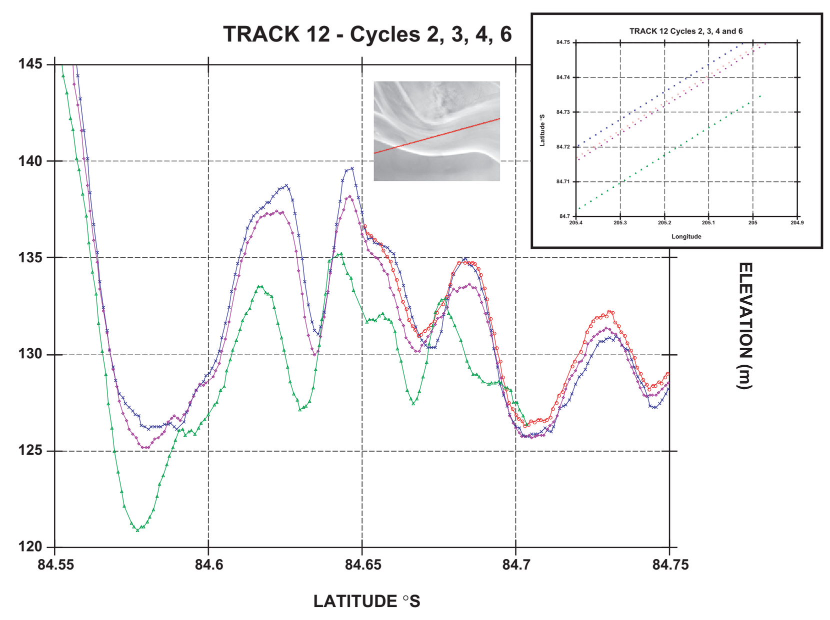
Mt. Sidley - Executive Committee Range



Pine Island Glacier Across Flow



Siple Coast Ice Ridges and Ice Streams



Whillans Ice Stream, Along Flow Track Offset and Cloud/Aerosol Impact

Conclusions and Future Work:

- ICESat data can illustrate specific ice sheet features in detail despite limitations in the initial GLAS Laser 1 coverage and the effects of atmospheric phenomena
- I-SIPS Release 11 data is mature and capable of supporting glaciological studies, Release 12 corrects minor problems and will be available soon for analysis
- Precisely locating West Antarctica's topographic divide with ICESat data will aid field work planning and enable refined atmospheric modeling of circulation
- Consistent data retrieval across large and/or hazardous areas of ice sheets is clearly demonstrated, evaluation of temporal variability is the next challenge
- Additional work will enable temporally-constrained precise elevation data sets to be generated from cloud-free crossover and repeat track data for specific areas

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